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ORIGINAL RESEARCH


# Evaluation of Malocclusion in MPDS

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## ABSTRACT

**Introduction:** Myofascial pain dysfunction syndrome (MPDS) is a disorder which is characterized by facial pain and limited mandibular function because of the complex nature of this disease. Malocclusion was never evaluated in MPDS patients to know its role. Electromyographic silent period durations of masseter were used for objective assessment of MPDS patients.

**Aim:** To evaluation of role of malocclusion in MPDS patients and also to study the EMG masseteric silent period pattern in MPDS patients in different malocclusions.

**Materials and methods:** Two groups, groups I and II of 75 subjects each, were included in this study. Groups I and II constituted the normal subjects and MPDS patients respectively. All these subjects in both the groups were again subdivided based on Angle's class I, II and III malocclusion. Electromyographic (EMG) silent period of masseteric muscle on both sides was measured for all the subjects in both the groups to know whether it differs according to the type of malocclusion.

**Results:** The silent period was more in group II (MPDS patients). There was no significant difference in the silent periods in Angle's class I, II and III malocclusion in group I, whereas in group II, there was a significant difference in the silent period in Angle's class II compared to Angle's class I and III. There was no significant difference between males and females.

**Conclusion:** MPDS patients are more in Angle's class I malocclusion. Silent period is more in Angle's class II malocclusion of MPDS group. Clinical significance: The EMG masseter silent period duration can be advantageously utilized as an adjunct to clinical examination for diagnosis of myofascial pain dysfunction syndrome. It is enough if one side masseter muscle is measured for silent period duration.

**Keywords:** MPDS, Malocclusion, Masseteric silent period.

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## INTRODUCTION

Myofascial pain dysfunction syndrome (MPDS) is a disorder which is characterized by facial pain and limited mandibular function because of the complex nature of this disease. The functional disorder of MPDS could lead to organic changes in the temporomandibular joint (TMJ) if the problem became chronic. Current controversy about etiology of MPDS is essentially between two major concepts occlusal disharmony and psychophysiologic factors and 'several investigators' advocate a combination of both. The supporters of each of these concepts agree that most TMJ dysfunction problems are manifested primarily in the masticatory muscles, rather than in the TMJ itself.

The silent period has attracted special interest since it was discovered that silent period duration is prolonged in jaw elevator muscles of patients with symptoms of mandibular pain or dysfunction. This period of absent electromyographic activity may be caused by active inhibitory influences of different kinds, but it may also be a pause due to exhaustion of the alpha motor neurons after the initial efferent volley. Electromyographic silent period durations of masseter were used for objective assessment of MPDS patients. Studies have shown a direct correlation between the mean duration of silent period and the severity of the patient's symptoms.

Though the occlusal disturbances are a cause in MPDS, there are no studies that evaluated the role of malocclusion in the MPDS. Hence, this study was conducted to find the same.

## AIMS AND OBJBCTIVES

1. Evaluation of role of malocclusion in MPDS patients.
2. To study the EMG masseteric silent period pattern in Indian population constituting in different malocclusions.

### MPDS Historical Perspective

Anatomical causes were first postulated in 1918, when it was suggested that loss of vertical dimension resulted in damage to the meniscus, condyle and glenoid fossa of TMJ.[1]

Skeletal muscles in spasm could be a source of pain was mentioned in 1940s by Travell.[2] Schwartz[2] hypothesized that stress was a significant cause of the clenching and

grinding habits, which resulted in spasm of the muscles of mastication. His work was also important because it relegated occlusal abnormalities to a secondary role in the etiology of the pain syndrome. Eversole and Machado subdivided temporomandibular joint dysfunction syndrome into two subgroups: (1) myogenic facial pain and (2) TMJ internal derangements (TMJID).[3] Since the clinical findings are similar, it has been assumed that previous studies may have included both of these disorders as MPDS/TMJDS.

Electromyography is the recording and study of the electrical activity (voluntary and spontaneous) of muscle. It is a valuable extension to the clinical examination and a useful research tool. Electromyographic studies supplement the clinical examination by providing additional precision, detail and objectivity and delineate a variety of pathologic changes that are clinically either obscure or undetectable.

Electrical studies also allow quantitative assessment of reflex amplitude and latencies as well as complex motor phenomena.[4,5] The Silent Period is defined as a transient reflex pause in muscle activity, following an experimentally produced tap on the chin of subjects whose teeth were clenched together in isometric contraction (Jaw-Jerk reflex).[6]

EMG silent periods may be induced by pain and other oral sensations by tooth contact, and during normal masticatory functioning.[3,4] An artificial masseteric EMG silent period can be induced by a jaw jerk. A jaw reflex elicited during voluntary clenching is immediately followed by a brief pause in the EMG activity of the masseter, referred to as the masseteric silent period.[5]

## Mechanism of Silent Period Phenomena

The silent period may be caused by active inhibitory influences of different kinds, but it may also be a pause due to exhaustion of the alpha motor neurons after the initial efferent volley.[7] Unlike the silent period in peripheral limb reflexes, the silent period of the masseter cannot be abolished by voluntary effort, indicating a source of persistent active inhibition or a marked disfacilitation of the masseteric motor neuron pool.[8] Silent periods have been elicited by electrical stimulation of receptors of the skin or oral mucosa and by receptors in the periodontal ligament.[9] There is an idea that there is probably no single inhibitory mechanism for muscle silent periods.[10] This is particularly true of the stomatognathic muscles which potentially have more inhibitory mechanisms than limb musculature. In addition, increasing the level of masseter muscle activity is shown to decrease the duration of inhibition produced by innocuous and noxious stimulation of facial and intraoral regions. These indicate that the duration of silent period depends on the level of initial muscle activity.[11]

The current controversy about etiology of pain dysfunction syndrome is essentially between two major concepts, occlusal disharmony and psychophysiologic factors and several investigators advocate a combination of both. The great importance previously attached to occlusal factors in the etiology of mandibular dysfunction has lately been seriously questioned on the basis clinical, epidemiological and neurophysiological studies. There appears to have developed no real consensus as to just what part occlusal discrepancies play etiologically in TMJ disorders.

Many studies support the concept of multifactorial etiology of mandibular dysfunction, the occlusal factors in general being of minor importance.[12,13] No specific type of occlusal pattern had any significant influence on signs and symptoms of mandibular dysfunction.[12] Reviewing the literature on this subject, Carlsson and Droukas concluded that occlusal factors may be masked by other etiologic components being of minor importance in some and perhaps a major etiologic factor in others. There have been differing standards for judging normal occlusion (Possett 1957, Okeson, Ramford, etc.) occlusal interference serves primarily as a predisposing factor that requires activating before it becomes etiologically important. Emotional tension and bruxism are the important activating factors.[14]

## MATERIALS AND METHODS

### Subjects

#### *Group I—Normal Subjects*

Seventy-five asymptomatic normal healthy individuals (39 males, 36 females) consisting mostly students in the age group of 17 to 27 years were selected as control group. These 75 individuals had no history of pain in the TMJ, ears pre-auricular region and clinical examination failed to reveal any symptoms of dysfunction, such as pain on palpation of muscles of mastication, crepitus or limitation/deviation on opening. They ranged in age from 17 to 38 years with a mean age of 22. 67 years.

All the patients who were selected randomly were also divided based on Angle's classification of malocclusion.

#### *Group II - Subjects with Symptoms of MPDS*

Seventy-five individuals (40 males, 35 females) ranging in age from 16 to 50 years were included in this group for study. They were randomly selected from those patients who were seen in private clinics for complaints of facial pain including head and neck regions. Only those patients were taken up for the study who fulfilled the criteria for myofascial pain dysfunction syndrome (MPDS). The clinical criteria of

MPDS were based on the presence of four cardinal signs and symptoms along with two negative characteristics. The cardinal signs and symptoms were:

1. Unilateral or bilateral dull pain in the ear or preauricular region that is commonly worse on awakening.
2. Tenderness of one or more muscles of mastication on palpation.
3. Clicking or popping noise in the TMJ.
4. Limitation or deviation of mandible on opening.

The negative characteristics were

1. An absence of clinical, and roentgenographic evidence of organic changes in the temporomandibular joint itself.
2. Lack of tenderness in the temporomandibular joint when it is palpated through external auditory meatus.

Only those patients who fulfilled at least three of the four cardinal features and the above-mentioned two negative characteristics of myofascial pain dysfunction syndrome were included in this group II for study. This group ranged in age from 15 to 50 years with a mean age of 24.82 years. There were 35 females and 10 males.

Subjects from this group were also divided based on Angle's classification of malocclusion.

### EMG Protocol

EMG was done in the diagnostic center. After explanation of the procedure the subjects were instructed to lie down over EMG examination table (with a firm mattress). The head was well supported over a pillow and the subject was instructed to bring the chin forward and look straight up. Each silent period was elicited and recorded a minimum of 10 times at each session to check for accuracy and consistency. The silent period was measured as the time from the end of the compound action potential to the reappearance in the EMG of the first synchronous compound action potential whose amplitude was at least 0.2 mV. For all subjects the masseter muscle silent periods were recorded bilaterally. A standardized procedure for electrode placement was followed. In determining the site for placement of the surface electrodes over the masseter muscle, the bulk of the superficial portion was palpated while the subject performed open-clench mandibular cycles.

One reference electrode was placed over the zygomatic process and the other, active electrode, over the belly of the masseter muscle. Another electrode placed over the forehead, served as the ground. Recordings were made using 11 mm surface silver/silver chloride biopotential electrodes filled with electrolyte gel that were taped over the masseter muscles of both sides after the skin had been vigorously scrubbed with an acetone swab. The signal was amplified by a high gain amplifier with the lower and upper cut frequencies at 20 and 2000 Hz respectively. The silent period was induced by a tap on the mandibular symphysis with a tendon hammer during a sustained contraction of the masseter muscles obtained by having the patients clench their teeth in a maximal intercuspal position, i.e. centric occlusion. The sweep on oscilloscope was triggered externally through the tendon hammer synchronously with the tap. To see the silent period clearly, the sweep was delayed by two divisions. The subjects were instructed to relax the mandible, as soon as recording was complete to reduce the possibility of inducing muscle fatigue. One minute between each tap was allowed. Using this technique, silent periods were reliably reproduced.

The masseter muscles silent periods of the asymptomatic group (group I) were measured at only one session. All the patients of MPDS constituting the group II were monitored EMG silent period durations of masseters for at least one session, i.e. after their diagnosis.

## RESULTS

The population studied consisted of 150 individuals in good general health. Their age ranged from 16 to 50 years. Seventy-five subjects had no history of pain in the TMJ, ears, preauricular regions and clinical examination failed to reveal any signs and symptoms of dysfunction, such as pain on palpation of muscles of mastication, crepitus, limitation and/or deviation of mandible on opening. These subjects formed a normal control group and were denoted as group I. The other 75 individuals were randomly selected from patients attending the private clinics. All 75 individuals fulfilled the three of the four positive cardinal features and two negative features of myofascial pain dysfunction syndrome. These patients formed the MPDS group and were denoted as group II.

### Group I Data Analysis

Seventy-five asymptomatic, dentally normal healthy adults were included in this group. 39 were men and 36 were women. Their ages ranged from 17 years to 27 years, with mean age of 22.67 years. The distribution by malocclusion of this group is given in Table 1.

The EMG masseteric silent period duration was determined for both right and left masseter muscles as described in the protocol. The subjects were asked to clench maximally in centric occlusion position and the tap over the chin was used to evoke the silent periods of the

**Table 1:** Group I distribution by malocclusion

| *S. no.* | *Angle's classification of occlusion* | *Number* | *Percentage* |
|---|---|---|---|
| 1 | Class I | 57 | 76 |
| 2 | Class II | 14 | 18.66 |
| 3 | Class III | 4 | 5.33 |

masseters. The recording was repeated for 10 times. Mean of 10 observations of silent period duration for right and left masseter muscles are separately calculated.

The mean silent periods for right and left masseter muscles in males and females in group I is given in Table 2. The mean silent period for different angle's classification of malocclusion was given in Table 3.

The mean silent period duration for all 75 individuals for right masseter muscle was 21.24 m/sec. with a range of 14 to 34 m/sec The same for the left masseter was 21.18 m/sec with a range of 14 to 34 m/sec. The mean silent period durations for right and left masseter muscles were subjected to t-test and it showed no statistically significant difference between right and left masseteric silent period durations. Since, the right masseter and left masseter muscle silent period durations does not differ significantly, the right masseter silent period duration was used to correlate with Angle's classification of malocclusion.

### Group II Data Analysis

Myofascial pain dysfunction syndrome patients were included in this group. Forty patients were men and 35 patients were women. Their ages ranged from 16 to 50 years, with mean age 24.82 years. The distribution by malocclusion of this group is given in Table 4. The mean silent periods for right and left masseter muscles in males and females in group I is given in Table 5 where as the mean silent period for different Angle's classification of malocclusion was given in Table 6.

There were more patients of Angle's class I malocclusion compared to class II and III. The mean silent period duration for all 75 individuals for right masseter muscle was 57.55 m/sec. with a range of 18 m/sec to 29 m/sec. The same for the left masseter was 57.39 m/sec with a range of 17 m/sec to 32 m/sec. The mean silent period durations for right and left masseter muscles were subjected to t-test and it showed no statistically significant difference between right and left masseteric silent period durations. Since, the right masseter and left masseter muscle silent period durations does not differ significantly, the right masseter silent period duration was used to correlate with Angle's classification of malocclusion.

The mean masseteric silent period in Angle's class II malocclusion was significantly different from Angle's class I and III. There was no significant difference between Angle's class I and III.

**Table 2:** Group I mean silent periods for right and left masseter muscles in males and females

| *Sex* | *Mean right masseteric silent period in m/sec* | *Mean left masseteric silent period in m/sec* |
|---|---|---|
| Males (39) | 21.31 m/sec | 21.20 m/sec |
| Females (36) | 20.98 m/sec | 21.12 m/sec |

**Table 3:** Group I mean silent period for different Angle's classification of malocclusion

| *Angle's classification* | *Mean RT masseter silent period* | *Mean left masseter silent period* |
|---|---|---|
| Class I | 21.16 m/sec | 21.30 m/sec |
| Class II | 21.80 m/sec | 20.80 m/sec |
| Class III | 21.00 m/sec | 20.00 m/sec |

**Table 4:** Group II distribution by malocclusion

| *S. No.* | *Angles classification of occlusion* | *Number* | *Percentage* |
|---|---|---|---|
| 1 | Class I | 48 | 64 |
| 2 | Class II | 18 | 24 |
| 3 | Class III | 9 | 12 |

## DISCUSSION

Myofacial pain dysfunction syndrome (MPDS) is a disorder which is characterized by facial pain and limited mandibular function. Chronic masticatory muscle spasm of psychophysiologic origin is now recognized as the most common basis of the symptoms.

Review of literature is replete with controversies regarding various concepts of myofascial pain dysfunction syndrome. There has been no clear understanding and distinction between various disturbances of TMJ. The dimensions of disagreement in clinical dental research extend from the nomenclature to the etiological theories to the resultant treatment modalities. The literature indicates that the diagnosis, etiology and presentation of MPDS are complex. The silent period is defined as a transient reflex pause in muscle activity following functional tooth contact or following an experimentally produced tap on the chin of subjects whose teeth are clenched together in isometric contraction (Jaw Jerk reflex). Since, the literature review could not find the role of malocclusion in MPDS, and the relationship of silent period in different malocclusions in patients with MPDS, this study was carried out. In the present study, we have ruled out intracapsular disorders of TMJ and certain atypical facial pain syndromes by adhering to the clinical criteria both positive and negative.

**Table 5:** Group II mean silent periods for right and left masseter muscles in males and females

| *Sex* | *Mean right masseteric silent period in m/sec* | *Mean left masseteric silent period in m/sec* |
|---|---|---|
| Males (40) | 59.49 m/sec | 59.60 m/sec |
| Females (35) | 55.61 m/sec | 55.19 m/sec |

**Table 6:** Group II mean silent period for different Angle's classification of malocclusion

| *Angle's classification* | *Mean RT masseter silent period* | *Mean left masseter silent period* |
|---|---|---|
| Class I | 58.59 m/sec | 59.04 m/sec |
| Class II | 48.11 m/sec | 48.30 m/sec |
| Class III | 58.05 m/sec | 58.01 m/sec |

From the results it was found that Angle's class I malocclusions are more in both the groups. The silent period is not significantly different in all the three malocclusions. However in the MPDS group, silent period was significantly different compared to the control/group I.

The silent period in Angle's class II was significantly different compared to the class I and III groups. The increase in silent period in Angle's class II might be more due to the damaging nature of class II malocclusion or because of more occlusal disturbances.

The EMG silent period duration was determined for right and left masseter muscles for all 150 individuals. McNamara et al recommended that if the silent period duration following jaw tap stimulation is used as a laboratory test for patients with functional disturbances of the masticatory system, the bite load should be recorded.[11]

## CONCLUSION

The present study of myofascial pain dysfunction syndrome has been undertaken to see whether there can be more clarity of understanding regarding the role of malocclusion in the initiation of this condition.

1. MPDS patients are more in Angle's class I malocclusion.
2. Silent period is similar all three malocclusions of non MPDS group.
3. Silent period is more in Angle's class II malocclusion of MPDS group.
4. It is enough if one side masseter muscle is measured for silent period duration.

### Clinical Significance

1. The EMG masseter silent period duration can be advantageously utilized as an adjunct to clinical examination for diagnosis of myofascial pain dysfunction syndrome.
2. It is enough if one side masseter muscle is measured for silent period duration.

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